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## Tropical Storms of the Eastern North Pacific Ocean. By Willis Edwin Hurd, U. S. Weather Bureau.

eccompanied by heavy rain, wind increasing steadily and barometer dropping fa

barometer rising gradually. Wind at 8 p. m. SSW., barometer 29.83, light rains.

September 2, 4 a. m.-Wind SE. 3, barometer 29.90. Decided to bring ship back on

THE CYCLONE OF SEPTEMBER 9-10, 1922.

thirty-three years of seafaring experience. Mental and written notes were made by the

studied, the facts studiously classified, and the suggestions advanced laboriously thought

second officer during and for five days after the storm. These notes were carefully

II. OBJECTIVE.

out, with conclusions arrived at as outlined below.

as though it were of tropical origin,

Time. Course (true). Wind. Force. Barometer.

at noon, September 10, lat. 16° 38' N., lon. 114° 35' W.:

V. PROGNOSIS.

29.54 8 a. m., engine full speed ahead.

By Second Officer David Polowe and other officers.

FROM LOG OF WEST CATANACE.

like Redfield, Piddington, Reid, Thom, Dove, and Meldrum—names familiar,

The chart was originally published as an adjunct to the author's report on in 17° 30′ N., 104° W.; heavy southwesterly swell at 4 p. m. Here are shown blowing a hurricane, pressure at its lowest, 28.89 inches. The tempest con
American steamship, Capt. A. W. M. Knip, Balboa to San Pedro, "encountered in 17° 30′ N., 104° W.; heavy southwesterly swell at 4 p. m. Here are shown blowing a hurricane, pressure at its lowest, 28.89 inches. The tempest con
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of the monsoon belt and the coast, where calms and baffling airs predominate, view" of June, 1922. gales of various origins here and there break upon the atmospheric sluggish- The rainy-season cyclones may be looked for in May or June. From this

years has occurred which can not be fully tracked. Off the Mexican coast, the southwest hurricanes blow on the Pacific coast of Mexico . . on the contrary, scarcely a storm can be traced with absolute accuracy, for to the area of low pressure that then prevails." the following reasons: This region is deficient in reporting islands, Clipdegree affect the Mexican and Central American coasts proper. Moreover, 27 to September 1 two distinct hurricanes were observed in the neighborhood cyclone belts, do not thoroughly cover them. Thus, steamships on the west depth of this depression and the occurrence of a hurricane. coast routes may not become sufficiently involved in a storm to detect its As in other tropical storm regions of the Northern Hemisphere, August, Sepmiles to the westward. Again, considerable storm information may have been November appear with a considerably smaller number of cyclones, though much narrower width than the whirls of the great tropical cyclone regions, December the number is negligible. and are shorter lived.

sources concerning certain devastations of towns or shipping. These sources number of miles from their centers, yet the exception, which seems to occur include various war vessels stationed at anchor for a season in the harbors. more frequently than was formerly thought, is therefore all the more interesting.

known as chubascos were said to be expected at any time between May and light rain, and the unusual fall in pressure made it appear, as the captain con-November, springing up unexpectedly from any quarter, force 6 to 8, accomon October 28 and 29 of this year a great anticyclone lay over the southern beavier, and instead of beginning at instead of beginning at instead of beginning at great anticyclone lay over the southern beavier, and instead of beginning at great anticyclone lay over the southern beavier and instead of beginning at great anticyclone lay over the southern beavier and instead of beginning at instead to rise almost as rapidly as it had fallen. Wind blew steadily from 8.

On October 28 and 29 of this year a great anticyclone lay over the southern beavier and the greater part of Mexico. While southeasterly that of September 25–30, 1921. Its center lay outside of Lower California over that of September 25–30, 1921. Its center lay outside of Lower California over that of September 25–30, 1921. Its center lay outside of Lower California over the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales, if any, would have seemed most likely to occur off the southeasterly gales heavier, and instead of beginning at night they do so in the afternoon and terminate by violent storms, accompanied by very dangerous lightning and thunder, the end blowing from all points of the compass. The weather keep so this storm appears in another column.

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The storm do not interest the storm the storm appears in another column. of September, and it sometimes happens that the season terminates by a terrible hurri- account of this storm appears in another column.

gales for any portion of the Mexican region.

on the average once in 6 or 8 years. The storms thus referred to were undoubtedly the few visitations of the so-called cordonazos which ravaged Mazatlan, San Blas, and other ports and did not include those little-known cyclones which remained at sea. So far as is known, the larger part of the coast storms lost to observation may pass into the less inhabited regions of Mexico or Lower

findings of Redfield and others, would seem to indicate that genuine tropical as are the larger, and perhaps more important, ones of the better-recognized and neighboring vessels, if there be any, can be communicated with during a through W. to SW. hurricane localities. The rainy season of 1922, for instance, has produced at least five such storms, and few years in the Caribbean can lay claim to more. Indications sometimes point to a number of small hurricanes occurring within a few days of each other, as in 1922, over an area so small that it seems only

If we consider the oft-repeated statement that the majority of the prevailing winds in the cordonazos-meaning those hurricanes which have been experienced by coast observers—are from the southeast and southwest, and ask why this is so the answer is clear. The very position of the coast with reference to the general storm progression would place observers in the right-hand semi-

a strong wind commenced to blow from ESE., increasing in force and velocity plotted or its nature more definitely determined. until 12.30 p. m. At this hour the wind shifted from SE, to NW., the Fortin barometer dropping suddenly 4 mm." At Magdalena Bay on the same date the wind changed from northwest to west and then to southwest in squalls. At (Track IV, fig. 2.) The American sailing vessel Amaranth, Capt. E. W. Neil-San José del Cabo the storm began with a strong gale from east-northeast, "increasing in force toward daylight and with heavy rains veered to east.

and on the 14th the vessel finally ran into light southerly winds below the dissection it was felt as far south as Clipperton Island, where the schooner its inception it was felt as far south southers squalls, force 7, during September and part of the 30th, with barometer steady at 29.70.

About 4.30 p. m. (L. M. T.) of the 31st, when in lat. 15° 05′ N., lon. 119° 01′ W., the Barometer having steadily been falling during the night, it began to fat more rapidly and on the 14th the vessel finally ran into light southerly winds below the dissector of the 30th, with barometer steady at 29.70.

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to the westward occasional rain squalls, wind SE. At 6.45 clouds 10 nimbus, heavy rain, barometer 29.35 that the second rain squalls, wind SE. 2. At 7.15 barometer 29.93, passing rains, wind SE. 3. clouds nimbus 10. become an Asiatic typhoon. Cyclonic storms do occur in the neighborhood from 3 to 7. of the Hawaiian Islands; but they usually appear to have originated near by and to have a northward progression. Redfield speaks of a gale, named by him the "Cyclone of the Lark," observed on September 23, 1843, in 15° north latitude, 138° west longitude, and which he traces as moving westward from that point. The Deutsche Scewarte records a storm on September 21-24, 1870, which moved westward from its observed place of origin in 17° N., 141° W. Yet there is no reason to believe that either of these, or any other, may have been an extension of a cyclone of the region under consideration. Still, there remains the possibility of such a happening, paralleling the cases of those West Indian hurricanes of rare occurrence which have been traced back to an origin in the neighborhood of the Cape Verde Islands.

tions of cyclonic activity. In one the storms are rarely remote from land.

This was apparently moving in the same direction as its predecessor, its posi-They roughly parallel the coast and occasionally recurve and enter it. In the they roughly parallel the coast and occasionally recurve and enter at the hurricane continued with unabated strength till 4 p. m., then decreased to a strong gale other they are farther away and exhibit a greater tendency to proceed ocean-steamship was in 19° 46′ N. 119° W.; wind N. by E. 2; pressure 29.78 (corward in a northerly to west-northwesterly direction, although it is probable rected); heavy swell from the east. At 8 p. m. the wind increased, with 11 p. m. was heading north. An attempt was made to get the stern through the wind one may occasionally recurve (see fig. 3), passing into the land somewhat farther to the northward than do the majority of the coastwise storms that changes: move inland. The disturbances of this latter section are those most likely to be observed by vessels plying between Hawaii and the Panama Canal. Track III, fig. 2, shows a storm of this region which failed to follow a prescribed course. Looking at its point of origin, this hurricane of September 3-5, 1899 should apparently have proceeded up the coast. Instead, it moved southwest ward, on the 4th giving hurricane winds and an observed pressure of 28.8 inches. Only one previous cyclone is known to have taken a similar cours that occurring on July 31, 1882, point of origin near 13° N., 118° W.

probabilities of a cyclone center farmer out at sea.

The wind shifts were NE, through W. to SW.

assembled the beginnings of a great fund of material relating to the storms of access to this valuable contribution to the literature of the subject, since it was published in a form not permitting of widespread distribution, appearing and the February rains were experienced, but Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. B. F. Yost, United Subsequent reports of this hurricane coming from Mr. the sea, more particularly, perhaps, those of the Tropics.

In the warm seas, the hurricane of the West Indies, the typhoon of the warm seas, the hurricane of the West Indies, the typhoon of an American Squadron to the China Sea and Japan, performed in the warm seas, and the similar disturbances of the Indian Ocean, and the similar disturbance, and the valid in the Volume Indian Ocean, and the valid in the Volume I western racine ocean, and the same stated and many destroyed. As this is a maritime community, in again; after dark accompanied by thunder and lightning. Wind decreased gradually have thus become pretty familiar objects of common knowledge. Disturbing as years 1852, 1853, and 1854, under the Command of Common knowledge. mave thus become pretty tanimar objects of column thowseage. Platering as the first of the main arteries of ocean com
they are to the regions traversed by many of the main arteries of ocean com
United States Navy, by Order of the Government of the United States."

Wind decreased gradually to the first ocean at 10 p. m., and after 10 p. m., and after 10 p. m., and after 10 p. m., in 16° 51′ N., 100° 44′ W., the wind was WNW. 5, with the first ocean com
United States Navy, by Order of the Government of the United States." merce, it has become imperative that they be continually observed and forecast. Figure 2 is a chart of more recent storms which it has been possible to so rising pressure. This storm went into the coast. (Track V, fig. 2.) Of the lessor known cyclone areas, one is the island-strewn portion of the sufficiently identify as to trace, some approximately and some with known South Pacific. Another, and still less known, is the roughly triangular area accuracy. A few of these already have been referred to; others will be menhaving the Mexican and Central American west coasts as the eastern base tioned later. Four have been published previously on various issues of the Captain Sandberg, left Astoria bound for Valparaiso with a cargo of lumber.

southeast trades before their disappearance. Between the northern boundary University, and appearing in the Weather Bureau's "Monthly Weather Re-

ness, their time of greatest frequency being midsummer. It is over the eastern time until October or November a fairly permanent depression prevails over No cyclonic storms reported for this year. ness, their time of greatest frequency being madsummer. It is over the eastern half of this unsettled area that the greater part of the cyclonic storms develop.

Concerning these storms, at first thought it is singular that one should still be seeking special information. In the West Indies scarcely a storm in many be seeking special information. In the West Indies scarcely a storm in many permanent depression provides the castern and southward into Mexican coast waters, with a center southern Arizona and southward into Mexican coast waters, with a center which fluctuates, but may be placed roughly nearly over the Gulf of California.

Although there is a record of four cyclonic storms, none seems to have which fluctuates, but may be placed roughly nearly over the Gulf of California.

Prof. Cleveland Abbe asserted that "during these months (May acquired the intensity of a hurricane."

perton Island and the four volcanic islets of the Revilla Gigedo Group being days of August. Pressures over and to the southward of the Gulf of Caliuninhabited or practically so. Comparatively few storms in considerable fornia were considerably below the normal, and during the period from August vessels as a rule follow certain fixed routes which, while not outside the Not always, however, is there apparent so close a relationship between the

cyclonic nature, especially if the center, as frequently is the case, is some tember, and October are the months of greatest activity. June, July, and unreported. The majority of the storms of this region are undoubtedly of when they do occur in November they are usually severe. During May and

Most of our earliest knowledge of storms off this coast comes from scattered small in diameter that they do not influence weather conditions at a great seems to have been made to investigate the hurricanes of this region.

NE., SE., S., SW. This is Captain Topp's account: storms. (See fig. 1.) Since that time, difference of the British S. S. and support of the seems to have been made to investigate the hurricanes of the seem during the rainy season. In Mazatlan Bay, for instance, formidable gales wind, as observed from the vessel, and the backing from NNE. to NNW., the

but they are so violent and raise such a heavy sea that nothing can resist them.

Of the storms of small diameter, a further reference to a notificate how comparatively but they are so violent and raise such a heavy sea that nothing can resist them.

Chart, that of March, 1896, will perhaps suffice to indicate how comparatively block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the block to the seaward of the gulf at this time, there are the seaward of the gulf at this time, there are the seaward of the gulf at this time, there are the seaward of the gulf at this time, there are the seaward of the gulf at this time, the seaward of the gulf at this time, there are the seaward of the gulf at this time, the seaward of the gulf at Similarly, in the Gulf of California, SE. gales are said to be expected below small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be the portion of the coast small in area they may be and how narrow may be an arrow ma Guaymas at any time during the rainy season, "and occasionally," according to exposed to the high winds of a storm striking inland. We read that on the 20th Commodore (later Admiral) Dewey, U. S. N., "a local hurricane, known as of September, 1888, the German Bark Parnass, while in the harbor of Mazat-El Cordonazo, blows with great violence." A hurricane of this character oclan, was blown from her anchorage and suffered considerable damage from

Shipping heavy seas fore and aft; going half speed at 4 p. m. On the 21st the
lan, was blown from her anchorage and suffered considerable damage from

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lan, was blown from her anchorage and suffered considerable damage from the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21st the land of the speed at 4 p. m. On the 21s an, was blown from her anchorage and surfered considerable damage from morning position was 14° 00′ N., 103° 40′ W.; highest wind for the day, 10, moderate gales occurred at various times in the month, especially on the 11th hurricane winds. In the immediate neighborhood no such high winds were and 12th, between Salina Cruz and San Jose, Guatemala. The first known experienced, and the captain of a steamer that put into Mazatlan on the following day reported only a "fresh southwest wind and a steady barometer during shifts were S., SSW., W., SSW. thips at anchor were driven on shore,

Redfield refers to a terrific gale which, on November 1, 1839, surprised twelve

Redfield refers to a terrific gale which, on Royaltan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the harbor of Mazatlan. The greater part of the vessels were lost and birs in the first between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great circle track between able occurrence of intense cyclonic disturbances along the great

three vessels were lost in the road of San Blas and several people drowned. rapid, but probably is not often more than 12 to 15 miles an hour, and a speed SE. to SSE.; lowest pressure 29.66. Bearing further upon this subject is a report from the U. S. S. Cleveland, of 4 or 5 miles an hour has been observed. Sometimes, indeed, it appears that which was stationed for several days during September, 1921, in the harbor of the disturbance is almost or quite at a standstill, and without further knowl. Amapala. The information was furnished by E. F. McCartin, acting weather edge concerning it one is tempted to place it in the same category as Meldrum

dimensions, its progressive development is rapid, so that there may be little the 8th and 9th the vessel was in approximately 13° 30′ N., 96° 20′ W., buffeted plunged into the coast. Up to this point the disturbance was fairly closely preliminary warning from sea or weather. Occasionally a captain reports no by ENE. to NE. gales, force 9. On the 10th she moved into 12° 20' N., 96° followed by the American steamships Hattie Luckenback and Santa Rosalia, warning at all that he could construe as evidence of the proximity of a severe

30' W., where with light NE, winds, she was able to continue her course. cyclone until the gale was upon him and the suddenly falling barometer indicated the possibilities to come. However, the mariner who fully realizes he is traversing a sea that is perhaps more treacherous than any other, except it may be the seas of India, will be guarded by any and all unsettled conditions. Evidences of three cyclones are at hand for the rainy season of 1917. The originate and die out without seriously affecting land, though some which are
in the meets with northeasterly gales, force 7 or 8, with falling pressure, he first was observed by the British S. S. Warrior on the morning of September may be sure he is entering a cyclone, the indications of which perhaps point to 16, in 19° 57' N., 109° 49' W. The wind was NW. 6 at the time, but the presone of only moderate intensity. The first windshift, however, may come with sure had fallen to 29.69, corrected. At 3.45 p. m., in 19° 45' N., 109° 26' W., a whole-hurricane blast, so it is always wise to be prepared. Frequently a the wind was NW. 8, and pressure at its lowest, 29.59 inches. The gale abated

vessel's aerials are blown away by violent gusts. But if these remain intact early on the following day. The observed wind shifts were from NNW. storm the resulting information, if furnished to the Weather Bureau, may aid On the 27th of September the British S. S. El Lobo encountered a SW. gale, materially in determining the history of that storm. Obviously, a gale at sea force 8, in 13° 06' N., 101° 20' W.; lowest pressure 29.71 inches. The weather of the British Isles. may arise from a thunderstorm, but in that case the burst will be accompanied moderated early on the 28th.

circle of most storms, where such winds prevail. Only if the cyclone passed influence they have been cast that for this and other reasons it is now thought desirable to enumerate and describe all the known storms of the past few tions than common were received from vessels plying the waters of this region. notes: To cite an example from the U. S. Pilot Chart of the North Pacific Ocean for years beginning, say, with those of 1912. This may lead to obtaining additional However, there were a goodly number of observations of the great storm of However, there were a goodly number of observations of the great storm of However, there were a goodly number of observations of the great storm of the North Pacific Ocean for years beginning, say, with those of 1912. This may lead to obtaining additional March, 1896. Concerning a report to the Hydrographic Office from the Direction also may be inches, occurred at 4 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 4 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 4 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 4 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 4 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 4 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N., lon. 101° 51′ W.; gale ended inches, occurred at 5 a. m. same date, in lat, 17° 15′ N. same date, in l tor of the Observatory of Culiacan, Province of Sinalou, describing the storm directed to future needs in this connection. Thus an extra observation or two from cyclones, unless the gale of September 10-11, reported by the Danish on 10th; highest force of wind, 7, SE.; shifts, ESE.-SE. of October 1, 1895 (fig. 2, Track I), the narrative goes on to say that "at 9 a. m. may so increase the knowledge of a storm that its course may be more fully M. S. Perri of Copenhagen, San Francisco toward Panama, may have been such.

sen, Observer A. M. Johnson, Portland toward varparaiso, while in lat. It is at noon, September 9, lat. 16° 12′ N., lon. 118° 55′ W., noted the approaching disturbance early in the morning the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force 9, lowest pressure 29.76, in the influence of a southeasterly gale, highest force

Anna, lying at anchor, experienced southwest squalls, force 7, during September 29 and part of the 30th, with barometer steady at 29.70.

It has been suggested at various times that these hurricanes may move far to the westward occasionally. Through some rare combination of meteoro-

	Storm log.			
	Position.	Wind.	Pressure.	Course.
Aug, 10— 4 s. m. 6 s. m. 8 s. m. 10 s. m. 11 s. m. 12 noon. 2 p. m. Aug, 11— 4 s. m.	17° 59′ N., 118° 55′ W	N. 5. N. by W. 10. N. by W. 10. N. by W. 10. N. by N. 11. NW. 11. SW. by W. 9. SSW. 7. SSE. 6.	29, 63 29, 33 29, 13 28, 98 29, 03 29, 08 29, 28 29, 72	S. 40° E do. S. 58° E S. 69° E N. 68° E N. 45° E

From the charts presented herewith (figs. 1 and 2), it can be seen readily

The second identified cyclone of this year was observed on the 19th and

The storm center passed close north and east of the ship at 10 a. m. The force of the that for the area under discussion there are two more or less well-defined sec-

	Position.	Wind.	Pressure.
Sept. 19— 4 p. m	19° 29' N., 116° 47' W. 19° 25' N., 116° 17' W. 19° 22' N., 116° 01' W. Hove to. 10° 19' N., 115° 38' W.	N. 6. N. by W. 7-8. NE. 8-10. E. 10. E. 9. ESE. 6.	29, 68 29, 56 29, 21 29, 22 29, 40 29, 70

nature of the cyclone had become definitely established, an intensive study reproduction of approximate storm tracks as drawn by William C. Redfield, Cruz, observed a steady ESE, gale from 4 a. m. to 4 p. m., force 7 to 9, pressure heavy rain squalls accompanied by thunder and lightning, and suddenly falling shown by Track XIII, fig. 2. of these so-called "meteors" was made by students the world over. Men well known as one of the pioneer American investigators in meteorology.

and the western apex not far from 20° north latitude, 130° west longitude. Pacific Pilot Chart. The track of the storm of September 14-17, 1918, here On the 23d of the month the noon observations showed the vessel to be in 17° and the western ages not far from 20 horar attender, no west following morning the glass began

In June the northeast trades still extend far eastward into this region shown, is a correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown, is a correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown, is a correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown, is a correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown, is a correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown, is a correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown, is a correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown, is a correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown as the correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown as the correction of the track published as No. XIII on the September, 49' N., 121° 22' W. At 2 o'clock of the following morning the glass began shown as the correction of the track published as No. XIII on the September at the correction of the track published as No. XIII on the september at the correction of the track published as No. XIII on the september at the correction of the track published as No. XIII on the september at the correction of the correction of the correction of the correction of the correction In June the northeast trades still extend far eastward into this region shown, is a correction of the track published as No. XIII on the vertebrack published as No. X California and even fartner southward. Dater in the season the trades retreat occeanward, though the northwesterlies in some measure continue. Between Tartner southward that the forestaysails went by the board, leaving the vessel to go broadthe 95th and 115th meridians, 5th and 10th parallels, an approximation from foreign publications. Many of these have been republished recently in side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the schooner, and shortly afterward side to the sea. Heavy waves now swept the school shortly afterward side to the sea. Heavy waves now swept the school shortly afterward side to the sea. Heavy waves now swept the school shortly afterward side to the sea. Heavy waves now swept the school shortly afterward side to the sea.

by the American S. S. Santa Cecilia, Capt. R. T. Anderson, Colon toward San highest force of the wind, SW. 8, at 8 a. m. of the 10th, in 14° 36' N., 104 08'

	Position.	Wind.	Pressure.
July 4— 6 a. m	10° 30′ N., 82° 45′ W.	SE. 6	29. 8
	11° 45′ N., 91° 00′ W.	NE. 8.	29. 8
	12° 28′ N., 92° 16′ W.	ESE. 8.	29. 7
	13° 35′ N., 94° 30′ W.	NNE. 8.	29. 7
	15° 00′ N., 99° 03′ W.	NNE. 7.	29. 7

July 1. During the squally period she kept a steady course, in spit While there seems to be no doubt that the majority of these storms are so indicate a class well as the wind shifts, might change in the direction of the wind noted."

Observer Chas. E. Topp, Honolulu toward Panama. (Track VII, fig. 2.) The experienced gales until 8 a. m. of the 13th, at which time the wind was S. 7 the subjoined report, the lowest observed pressure noted on board the one Thus, for cyclones that did not directly affect the coast but little information and solvent of the North Pacific Ocean for September, 1900, 18 of the North Pa is at hand prior to 1855, when Redfield described and charted his ramous 15 an account of the hurricane or August 27-31, 1859. (See Track 11, 185. 2.)

storms. (See fig. 1.) Since that time, until recently, no especial attempt storm on the 29th was central approximately in 18° 40′ N., 116° 20′ W. At Storms. (See fig. 1.) Since that time, until recently, no especial attempt storm on the 29th was central approximately in 18° 40′ N., 116° 20′ W. At Storms. (See fig. 1.) Since that time, until recently, no especial attempt storm on the 29th was central approximately in 18° 40′ N., 116° 20′ W. At Storms. (See fig. 1.) Since that time, until recently, no especial attempt storm on the 29th was central approximately in 18° 40′ N., 116° 20′ W. At Storms.

November, springing up unexpectedly from any quarter, force 6 to 8, accom
November, springing up unexpectedly from any quarter, force 6 to 8, accom
Solvent force 6 to 8, accom
Solv pamed by rain and thunder. The following quotation appearing in the south a whole gale; sea rose
"North Pacific Ocean and Japan Directory," and ascribed to Mr. Jeffrey, of
the Royal Navy, probably applies largely to similar disturbances off San Blas:

frequent lightning from the south a whole gale; sea rose
though extensive in area, was apparently of no great intensity, except perhaps
of the Royal Navy, probably applies largely to similar disturbances off San Blas: From June to November the sea and land breezes no longer blow, but in their stead reported by a vessel on the 27th. Another storm of considerable diameter was

tember, and it sometimes happens that the season terminates by a terrible nurriaccount or this storm appears in another column.

On the morning of the 19th she was in lat. 13° 17′ N., lon. 100° 18′ W. At

S. S. Jalapa in this area was accompanied by a fall of 0.08 inch in pressure.

Of the storms of small diameter, a further reference to a North Pacific Pilot

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On the morning of the 19th she was in lat. 13° 17′ N., lon. 100° 18′ W. At

On the morning of the 19th she was in lat. 13° 17′ N., lon. 100° 18′ W. At long the latest the she was accompanied by a fall of 0.08 inch in pressure.

all on board perished. He also mentions a storm of November 1, 1840, in which

The progressive movement of these storms is from slow to comparatively

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The progressive movement of these storms is from slow to comparatively.

In Amapala, Honduras, . . . violent squalls at sunset are frequent, sometimes reaching a wind force of 9 and lasting from 15 to 20 minutes. They are accompanied by ing a wind force of 9 and lasting from 15 to 20 minutes. They are accompanied by beavy rain and a sharp drop in temperature. These squalls usually develop at the by head weather, during which very high seas damaged her port boats. Fierce N., 104° W., and moved in a general northwesterly direction, accompanied by was found on the Pilot Chart of the North Pacific Ocean for the month of September, and at 30°N. 1922. It consisted of part of a sentence to the effect that "small but nevertheless by the signs usually experienced in typhoon waters. If the storm is of small various summer and autumn months do not indicate any great percentage of dimensions its progressive development is rapid so that there may be little the 8th and 9th the vessel was in approximately 13° 30′ N., 96° 20′ W., buffeted the north Pacific Ocean for the month of September, between that noon and 5 o'clock in the afternoon, when the wind springer of the wind on the Pilot Chart of the North Pacific Ocean for the wind on the Pilot Chart of the North Pacific Ocean for the wind a sentence to the effect that "small but nevertheless paragraph."

No, 116° W., on the 29th the storm is of small but nevertheless violent cyclones occur in the eastern part of the North Pacific Ocean for the wind the afternoon, when the wind springer is paragraph. It is a sentence to the effect that "small but nevertheless paragraph."

No, 116° W., on the 29th the storm is of small but nevertheless paragraph.

The wind roses on the Pilot Charts of the North Pacific Ocean for the wind the afternoon, when the wind springer is paragraph. It is a sentence to the effect that "small but nevertheless paragraph."

No, 116° W., on the 29th the storm is of small but nevertheless paragraph.

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The wind roses on the Pilot Charts of the North Pacific Ocean for the wind the afternoon, when the wind springer is paragraph.

The wind roses on the Pilot Charts of the North Pacific Ocean for the wind the afternoon and 5 o'clock in the afternoon, when the wind springer is paragraph.

The wind roses on the Pilot Charts of the North Pacific Ocean for the wind the afternoon and 5 o'clock in the afternoon, when the windication is paragraph.

The wind rose is a sentence to the effec The approach of one of these hurricanes, if of large dimensions, is preceded lightning and a nasty greenish sky were reported by the observer. The pres-

remain in doubt. Or it may be coincident with pressure conditions arising from enced what is plainly recognized as El Cordonazo—the coast "lash" of the extra-tropical cyclones over the adjacent oceanic or continental earlier writers—in spite of the fact that the prevailing winds in it were from the gale opened late on the 7th with wind from NNW., force 7, and lasted less antennæ go by the board. areas. In any event, positive conclusions are obtained only through obserorthwesterly directions. At 6 p. m. they were WNW. 7, pressure 29.60; 7 p. m.,

The gaie opened late on the 1th with white the with the adjacent of the 1th with white the with the adjacent of the 1th with white the with the adjacent of the 1th with white the with the adjacent of the 1th with white the with the adjacent of the 1th with white the with the adjacent of the 1th with white the with the adjacent of the 1th with white the with the adjacent of the 1th with white the 1th with white the adjacent of the 1th with white the 1th white th WNW. 10, pressure 29.56; 8 p. m., NW. 11, 29.61; 10 p. m., E. 2, 29.74 inches. wind velocity 9 from S. by W.; wind shifts, NNW. through W. to SW. by S.

The gale shifts were from WNW, through N. to SE. This gale began at 1 p. m. of the 10th, wind E. by S.; highest force between In 1922 five fully developed storms of the cyclonic type were noted, and all then and 4 p. m., 10 from the east; pressure 29.78 inches, in 22° 07' N., 109° 47' but the very last were identified wholly through a study of the reports sub-

lat. 16° 24′ N., lon. 100° 20′ W. This gale lasted until shortly after midnight, is Officer Martell's report:

propeller. The wind at midnight was ENE. 3, pressure 29.88 inches. Captain In this case the indications are that a cyclone of small dimensions was trav-Hansen thus relates his subsequent experiences:

September 15, 1918.—Increasing strength of wind from NE. and high running sea report concerning it is at hand. september 10, 1013.—Interesting Statement 10, 1015.—Interesting Statement 10, 1015.—Interestin ry thick and rainy. Fog signal. On account of the different directions of wind and very thick and rainy. Fog signal. On account of the different directions of wind and an American craft bound toward Balboa, Capt. Rene Blaustein; Second Officer 4.00 a.m. 5.00 a.m. vas approaching. At 5 a. m. endeavored to escape by steering SW., but as the ship was and Observer Robert W. Smith first noticed slight signs of a disturbance of a ballast it proved impossible to steer her and she continued on a southerly course with noon of August 27, in 16° 42′ N., 102° 10′ W. The barometer then read 29.83 wind on the port quarter. (Lat. 19° N., lon. 106° W.) The wind blew from NNE. (uncorrected), wind SE., force 1, weather squally, and sea rolling moderately. 8.00 a. m.... At, 8 a. m, the gale had increased to a violent hurricane accompanied by tremendous The table indicates the subsequent experiences: qualls and an exceptionally high and breaking sea. Barometer 736 mm. (28.98 in.), wind and sea 12. The ship was drifting southerly. She labored and was pitching and

engine going astern to enable us to increase the distance from the center, as the ship At 6 p. m. the ship came round and a south-southeasterly course was shaped.

by previous weather conditions," This is Captain Knip's account:

ings and industries. Several vessels were reported lost at sea.

The information concerning the tropical storms of the season of 1919 is wind, and decided to keep running. In fact, thought to have success, as barometer extremely meager. All consequential data seem confined to the brief reports started to rise between 4 and 5 a.m. After 5 barometer steady, sea increasing. After

From the 9th until the 13th of September, 1920, a storm was observed traveling up the coast from a point of origin approximated at near 15° N., 104½° W (Track X, fig. 2.) The first vessel to report it was the American S. S. West course to San Pedro, moreland, Capt. C. J. Stewart, Honolulu toward Panama. At 4 p. m. of the 9th, in 15° 33' N., 108° 10' W., the wind was NE. 4, pressure 29.74, with heavy thunder, and rough sea. The wind shifted at midnight to SW. by way of N. W.; lowest pressure 29.49.

The American S. S. West Cayote, Capt. Chas. Erickson, San Pedro south Aug. 31-10 a. m... 15° 30' N. 101° 30' W. W. 5... ward, observed the first storm appearances at midnight of the 9th: "Storm preceded by moderate SE, swell and very sultry. Barometer gave no indication." The wind shifts were E. to S., highest force 7; lowest pressure 29.78 nches, in 18° N., 104° W. The American S. S. Eastern Glade, southward bound, encountered the storm

from late on the 10th until 2 a.m. of the 12th. The lowest pressure, 29.74

inches, and the highest force of the wind, ESE. 9, were observed at 2 a. m. of the 11th, in 20° 30' N., 107° 40' W. The observer of this vessel reported that "no great change of barometer was experienced, neither was any market The Danish M. S. Annam, San Francisco toward Balboa, came into t The second storm of the season was undoubtedly a cyclone, and was observed influence of this storm with a gale from the E., force 8, at 8 a. m. of the 12th from the 4th to the 5th of September by the British S. S. Calliope, Captain and while in 22° 40' N., 110° 14' W.; pressure 751 mm. (29.57 in.). The vessel ently larger than the majority of hurricanes of this region. As will be seen by

12th. At 4.37 a. m. of the 13th her position was in 23° N., 110° 50' W. Her moreover, to emphasize the need for fuller data regarding these storms—a carpenter and the crew.

to southwesterly gales, if any, would have seemed most likely to occur off the

(Track XI, fig. 2.) Its special interest lies in the fact that it was of much

had a corrected barometer reading of 29.44, wind 5 from the east, followed by rising barometer. No gales reported.

became suddenly active. The records for that time at the Weather Bureau mariner as to whether the gale is of tropical or extra-tropical origin he should treat it ship's particular progress through the whirl. The winds were: stations at San Diego and Yuma, especially Yuma, show extraordinary and damaging rains. The coast storm had evidently merged with the Arizona 9. The third officer, Mr. John Brady, advances a very plausible reason for the paucity depression, but on October 1 was moving eastward. Thence it traversed the of information on this storm area, namely, that the great circle route between Honolulu 29. Confidence in Existing Storm Theories Established.—Virtually, all the facts Newfoundland on the 6th, and filled up on the 8th near the 25th meridian west ships. But, as Captain Murphy points out, the area under discussion has long been properly so doing.

The third cyclonic disturbance of 1921 (fig. 2, No. XII) was that which was be available somewhere. This storm moved in a northwesterly direction, and on the 9th and 10th was at noon, September 8, lat. 16° 58' N., lon. 117° 07' W.: further observed by the British S. S. Mongolian Prince, Capt. J. Halloway

The first indicated cyclonic storm of the season was that of August 10-11. W.; 4 p. m. to 8 p. m., SE. 8; 8 p. m. to midnight, SSE. 8. Pressure rose to mitted to the Weather Bureau by its cooperative marine observers, or to the (Track IV, fig. 2.) The American sailing vessel Amaranth, Capt. E. W. Nell-sen, Observer A. M. Johnson, Portland toward Valparaiso, while in lat. 17° 59'

Sen, Observer A. M. Johnson, Portland toward Valparaiso, while in lat. 17° 59'

Mephan. Honolulu to Panama. C. A. Martell, chief officer and observer. This indicates the complex of a couple of a coup

eling westward immediately to the south of the vessel's course. No other

Time.	Position.	Pres- sure.	Wind.	Weather.	Sea.
Aug. 27— 4.00 p. m 5.00 p. m 6.00 p. m 6.30 p. m 7.00 p. m 8.00 p. m 12.00 mid Aug. 28—4.00 a. m 8.00 a. m	15° 43′ N., 100° 30′ W	29. 75 29. 71 29. 56 29. 31 29. 60 29. 71 29. 75 29. 79 29. 79 29. 88	SE. 2. SE. 6. SE. 9. ESE. 11. SE. 10. SE. 9. SE. 8. SE. 6. SE. 4.	do.	Long, rolling se Heavy sea. do. do. do. do. Moderate SE. s do. do.

Three other American steamships, the Mobile City, the El Dorado, and the Francisco, encountered the storm at 8 a. m. of the 16th, in 22° N., 110° 02′ W. hours and positions during the 12 by 12 inches by 6 feet was sighted in approximately lat. 16° 27′ N., lon. 114° 50′ W. The lowest observed corrected pressure was 29.41 inches, at midnight, wind 29th and 30th, westerly to south-southwesterly gales were observed by the noted that the barometer dropped to 29.65 inches between 6 p. m. and 8 p. m.

15. The Day Before the last storm. These are generally grouped under the a strong SSE, breeze, which increased to a hurricane, with heavy seas and early indications of an oncoming tropical storm. These are generally grouped under the early indications of an oncoming tropical storm. On the same date the Japanese S. S. Persia-Maru, Capt. U. Kondo, San Fran- of the 29th. The sum of these scattered observations from the five vessels

During the middle 50 years of the nineteenth century, after the whirling

On September 28 the American S. S. Nevadan, San Francisco toward Salina cisco toward Salina of the hurricane at 1 a. m., meeting more or less involved reduces the storm movement to the approximate track beads of sky, wind, sea, pressure, temperature, and electrical phenomena. Thus within falling barometer." The wind worked round to S. and SSW., after which for to hurricane at 1 a. m., meeting more or less involved reduces the storm movement to the approximate track beads of sky, wind, sea, pressure, temperature, and electrical phenomena. Thus within falling barometer." The wind worked round to S. and SSW., after which for the hurricane at 1 a. m., meeting the twenty-four bours preceding a cyclone the ideal warnings are:

On September 28 the American S. S. Nevadan, San Francisco toward Salina cisco toward Salina the twenty-four bours preceding a cyclone the ideal warnings are:

During the middle 50 years of the nineteenth century, after the whirling shown by Track XIII for 2

Daytime, fine and clear at first, then clouds as above. Sunset, clouds are copper colored at the edges and stretch away into dark said: Night, heavy rain squalls. Often misty. WIND.—There is a freshening of the trades if in the trade belt. A shift of the

wind increases and remains steady in direction, the ship is probably in her head to wind. the seas become choppy, confused, and increase in height and violence.

1) PRESSURE.—The diurnal rate is affected downward. The barometer falls

SAN SALVADOR, Oct. 31.—Se steadily, and in the case of steamers much more rapidly than is indicated Pacific coast. by Piddington's "Horn Book."

TEMPERATURE.—The air seems to become warmer, more humid, and so oppres

sive as to cause bodily discomfort. ELECTRICAL PHENOMENA .--- Lurid streaks of light, lightning, and thunder. with certainty the passage of a tropical storm. Probably the surest guides are the wind, period from 1912 to 1922, distributed as follows: 1913, 1; 1915, 4; 16. In retrospect, the day preceding the cyclone of September 9-10, 1922, presents, as appear without such storms, but the evidence can not be said to be conclusive. shown by the log excerpts in paragraph 11, as nearly an ideal picture of an approaching what has been set forth here will serve to place the mariner more on his guard.

The year 1922, with a known record of 5 cyclones and a note of further violent. increased, the seas became heavier and more confused, the diurnal rate of the barometer gales of yet indeterminate type, shows a season of maximum activity and when entering in SW. Between 8 and 9 clearing in SW. Between 8 and 10 weather modical solutions. The trades nad respondent to show that he captain activity and solutions are allowed by the seas became heavier and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the deavier and more confused, the deavier and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the deavier and more confused, the diurnal rate of the barometer and more confused, the deavier and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused, the deavier and more confused, the diurnal rate of the barometer and more confused, the diurnal rate of the barometer and more confused and wind hall be confused and the confus ting fast. Decided to keep course with wind 4 points on starboard bow. At 5 p. m. the winds from the NNE, indicated that we were in the path of the storm, and this was wind SE. 4, barometer 29.78, decided to steer SW. Weather improving all the time, borne out later.

> (a) In the afternoon watch of the 8th, two tired-looking sea gulls flapping their way off toward the southwest just as any ship would in the left and navigable semicircle of a cyclone.
> (b) In the morning watch of the 9th, a bit of timber as described in paragraph 14 18. There were not the usual colored cloud effects, oppressive temperature, or electrical displays or sounds. The facts that the trades had freshened, the northerly swell in-

> creased, and the barometer affected as above noted, meant nothing more to us than that a "blow" was coming, i. e., a storm of extra-tropical nature, an ordinary gale. We felt confident after consulting our charts and books, that we were not in a cyclone area, and as a result of this feeling we ploughed through on our course until stopped by the ferocity of the winds and seas the next day. This course, unwittingly, propelled us rapidly toward the vortex which will be described later. 19. Suffice it to say that the importance of the waters surrounding the Revilla Gigedo Islands as a source of origin of cyclonic disturbances can not be overemphasized. VI. THE DAY OF THE STORM. 20. The excerpts from the ship's log, as shown in paragraph 12, tell the whole story.

tainous seas (about 25 feet in height and about 500 feet from crest to crest), the fact that for more than an hour we used every bit of the 3,500 horsepower available in an unsuccessful attempt to swing the ship so as to run before the storm with the wind on the starboard quarter (Captain Murphy has never before found this ship, or any other ship, unmanageable either in typhoon. West Indian hurricane, or in extra-tropical The fourth disturbance of this period, that of September 9-10, was appar- gale)—all these factors, combined, again show the true necessity for warning mariners 21. FUEL OIL AND STORM OIL were used efficaciously, especially when the ship was hove to with the engines stopped. It is here suggested that ships be fitted with storm-

encountered a fresh easterly gale and heavy SE. swell on the afternoon of the literature of the subject, both hydrographic and meteorological. It will serve, done being of the so-called "ginger-bread" variety, amenable to repair by the ship's

22. The extremely low pressure of 27.96 was recorded just before the ship entered the storm center. In fact the drop was so rapid that both the third and second officers experienced an ear pressure similar to that which one experiences in an elevator which is rapidly ascending a tall building. It was a case of dI/dT, the well-known physiological ormula, wherein dI equals the difference of intensity and dT the difference of time. 23. THE CENTER OF THE STORM was about 18 miles in diameter. We steamed across it . The American S. S. Bessemer City, of 5,685 gross tons, 3,500 horsepower, oil-burner, at a rate of about 8 knots per hour. Since the storm was progressing in an opposite full-laden with case pineapples from Honolulu, T. H., and bound for East Coast ports via 18 miles, as above stated. Between 15 and 18 miles would be a conservative estimate. The difference between sail and steam again became manifest, in so much as we considered master, Capt. John Murphy, and his senior watch officers decided to send in this special sky was brighter but not blue. The wind was nil. OBSERVATION.—Captain Murphy observed several little butterfiles fluttering helplessly 3. The depression was discussed from all angles by all the officers, men of from five to about within the center of the storm. This would seem to suggest a wind of land origin.

gant and began to blow with hurricane velocity. Note how closely this conforms with all the rules of the game. So much so that another suggestion is here advanced, namely that mariners obey strictly the storm laws when in cyclone areas, except when in so doing, as in our case, a course would lead to dangerous shoals. 25. THE CYCLONES OF THE REVILLA GIGEDO ISLANDS.—We take this opportunity to 4. The principal object of this report is to give due warning to mariners of the probable occurrence of intense cyclonic disturbances along the great circle track between Honolulu and Panama in the area bounded by latitudes 15° to 20° north and longitudes Gigedo Islands. They lie in the area discussed in this report, in the direct path of all clones having origin there. Situated thus they make the dangerous right semicircle a

24. A SHIFT OF WIND.—At 5 o'clock the wind shifted suddenly to the southeast quad-

(d) Pilot Charts, face and reverse, of the North Pacific Ocean for the months of lat. 17° 17' N., lon. 115° 10' W. We then calculated that we had set 308° and dri 110 miles. It was from these data that we computed the rate of progress of the storm to yield any data bearing directly on the region involved. The single exception noted the noon position of the 9th (we reckoned that we made no progress in any direction was found on the Pilot Chart of the North Pacific Ocean for the month of September, between that noon and 5 o'clock in the afternoon, when the wind shifted as described in

violent cyclones occur in the eastern part of the North Pacific Ocean, off the coast of 27. A Horizontal Cross Section of a Cyclone.—Attention is invited to the pre-Mexico and Central America." Attention is invited to the fact that this sentence is a bit cipitous descent of the barometer as contrasted with its slow rise. We have been led abliguous and therefore misleading. To the average mariner the word "violent" is to believe from this that the most likely contour of a horizontal cross section of a those from several Mexican and Peninsula stations, have allowed of a satistic to resemble somewhat a hard-boiled egg which has been cut in the mid line along its factory plotting of the track. The Santa Rosalia on the morning of the 29th that 3 to 4 per cent of the prevailing winds reach a force of 8 or over. The question at longitudinal axis. The median plane thus presents a yolk which, if imagined toward the ace arises, "Do these winds reach the force mentioned only during cyclones, or may pointed end of the egg, might be considered as the storm center, and surrounding the they also be of extra-tropical origin?" We are of the opinion that forces of 8 or over in yolk the albuminous white part which we can imagine as being the circulating winds. the region involved may also be of extra-tropical origin and they would, for that reason, • 28. Few Sers of Winds .- Attention is also invited to the fact that only three sets On the 30th the semipermanent low-pressure area over southwestern Arizona admit of treatment as ordinary gales. However, if any doubt exists in the mind of the of wind predominated throughout the entire storm. This was due, of course, to the (a) NNE, when in the left semicircle and in front of the storm, (b) SSE, when in the right semicircle and in rear of the storm.

continent, was observed in the Gulf of St. Lawrence on the night of the 4th, anama Canal); also, there are very few steamers traversing this track, thus lessening to cyclonic behavior. Thus, strengthened by actual experiences, mariners are advised to combined with another depression, and gained in energy to the eastward of the chances of an encounter with, and subsequent report of, a cyclone by officers of other strictly apply these theories to their practice at sea when the emergency exists for VII. THE DAY AFTER THE STORM, aversed by many, many sailing ships, in accordance with which fact some data must 30. THE TRACK OF THE STORM DEFINITELY ESTABLISHED .- On this day the wind and 10. The local nature of a cyclonic disturbance, i. e., its being confined to the diameter seas rapidly moderated, though the confused state of the latter persisted until midby a slight rise in pressure and the nature of the disturbance can not long of its track, may be given as an additional reason for the lack of data, and for the lack of data, and for the lack of data, and for the lack of t Japanese S. S. Lyons Maru, Capt. G. Fujimura, San Francisco toward Panama. of radio broadcasting of the existence of such a storm. Often, as in our case, the wire-

nates, which makes the parabolic nature of the track of the storm at once apparent. This point lies in latitude 16° N., and longitude 113° W. Since the eastern limits of 11. The day before the storm, noon, September 8, to noon, September 9, 1922; position traveled N. or NNE. and most likely was dissipated against the rocky and mountainous 31. STORM TRACK PLOTTED .-- A diagram of the track of the storm as definitely established by observations, dead reckoning, physical signs, and a knowledge of the usual behavior of cyclonic depressions is herewith inclosed. (See fig. 3.) 32. DIURNAL BAROMETRIC RATE REESTABLISHED .- The weather became fine and clear, the atmospheric pressure increased regularly until, on the morning of the 11th, the diurnal rate was finally restored. (See paragraph 13.) Thus the effect upon the barometer seems to give not only the earliest warning of an approaching cyclone bu

> VIII. CONCLUSIONS. 33. A general survey of the events of the three days leaves us with the following facts (a) The observance of sea-gull, butterfly, and ear-pressure phenomena is of theoretical rather than practical importance. (b) The existing theories on cyclonic behavior represent more than a working hypothe sis. They have the force of a law of nature; therefore, once assured that a storm is of c) The two surest and foremost criteria of an approaching cycone, when concomitant

also gives us the final and comforting assurance that another great experience has been

(1) A decided swell, not necessarily from the direction of the storm center. In the case covered by this report the swell came from the north, the wind (2) The downward effect upon the diurnal rate of the barometer (d) THE DISTANCE FROM STORM CENTER.—The difference between sail and steam is not sufficiently brought out in the literature bearing on this topic. There seems to be a tendency to cling to old-time data. This should be remedied. We contribute toward th end the suggestion that the table from Piddington's "Horn Book" be supplemented by table for steam. The necessary data may be obtained from this report and other report indoubtedly on file in the office of the Weather Bureau. (e) THE HURRICANES OF THE REVILLA GIGEDO ISLANDS.—All works dealing with cyclone behavior should devote a special paragraph to the region bounded by latitudes 15° to 2 Indian Ocean, and region of Samoa. A fitting name, one which is autosu one which immediately enables one to visualize the storm area lying in the eastern part

f) Notice to Mariners.—Mariners should be informed as soon as practicable of the

treacherous cyclones of the Revilla Gigedo Islands. The main object of this report will

have been accomplished when this information is so broadcasted through the various channels at the disposal of the Weather Bureau, 13. The day after the storm, noon, September 10, to noon, September 11, 1922; position Little is at hand concerning the fifth storm of the season. Except for the weather report of the American S. S. Mystic, Capt. J. W. Kirchner, New Orleans toward San Francisco, the information is mostly from press clippings. According to the Los Angeles Evening World of October 20, 1922, the British S. S. Bermuda, Norfolk to the Orient, via Portland, Oreg., was caught in a hurricane October 15 while passing Cape San Lucas. So much damage was done to the steamer, including the loss of the radio apparatus and the lifeboats, that she was forced to limp up the coast for repairs. The Mexican S. S. Guerrero was grounded during the same storm but was afterward salvaged and towed into San Diego for repairs. The motorship Isabella was wrecked,

with a loss of 15 out of 17 persons on board. The reports of the captain of the Mystio to the press and of the observer, The American S. S. City of Para, Capt. G. McKinnon, Balboa toward San Arizonian, bound toward San of the 9th of September, at 2.30, a bit of timber Second Officer Knowles, to the Weather Bureau, show that an exceptionally intense hurricane, probably of small dimensions, was raging. At 4.47 a. m. of the 15th the Mystic was in lat. 20° 50' N., lon. 108° 15' W., wind SSE. WNW. 9, in 23° 06' N., 110° 22' W. The City of Para was enveloped in the American S. S. Waukegan near 16° N., 100° 22' W. Second Officer Kessler and the state of the state of

This is one of the biggest barometer drops I have seen since I have been at sea.

SAN SALVADOR, Oct. 31.—Several vessels have foundered in a gale along the

From the various storm reports discussed in the foregoing, it seems assured that at least 26 cyclonic storms occurred in these waters during the 11-year

corrected pressure reading at 28.46 inches. The captain is reported to have The distribution for the 11 years according to months gives July 2, August

This article, in addition, appears on the backs of the following Bilst charts:

The Central arminan waters for april.

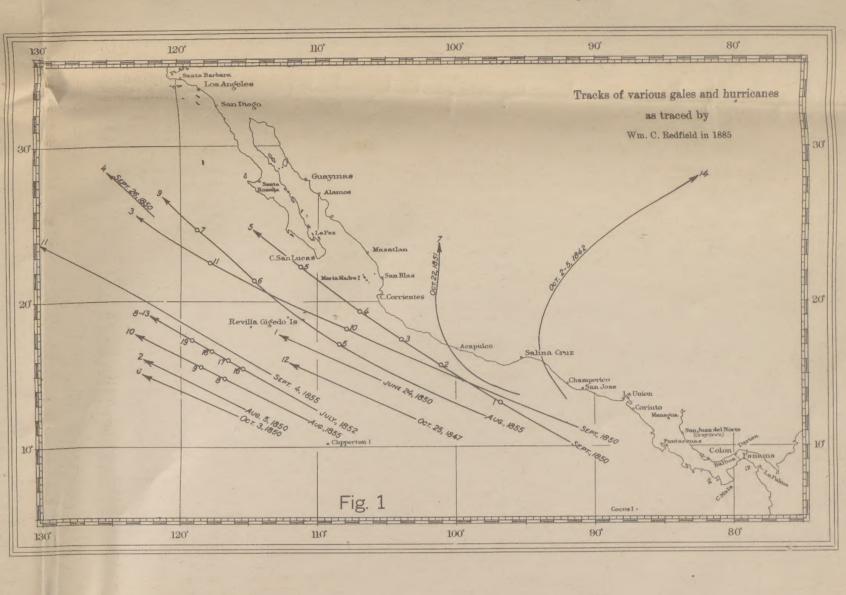
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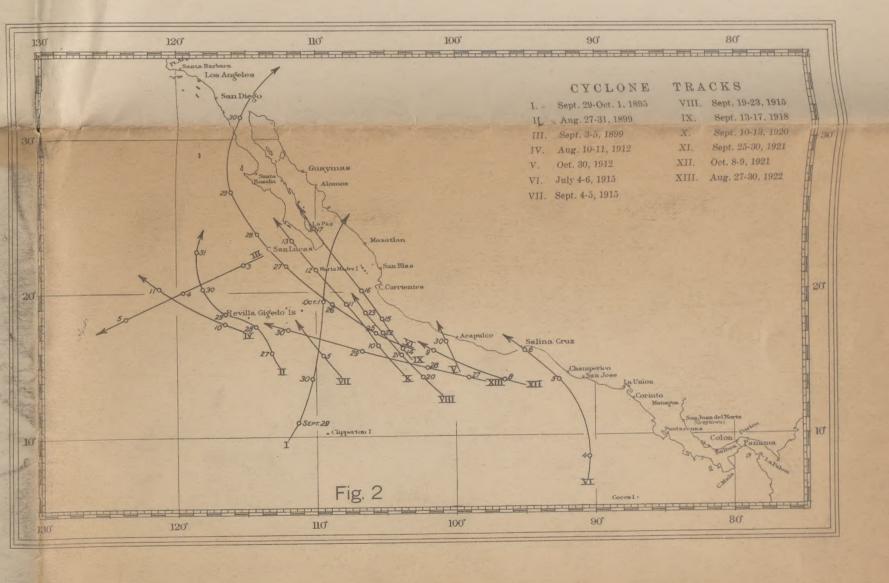
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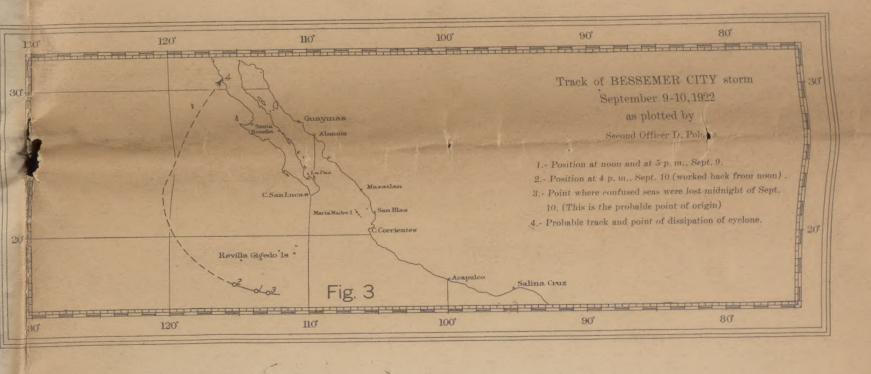
4, September 14, and October 6, thus crediting September with more than 50 per cent of the observed storms. The wind blew 120 miles an hour. I have never seen anything like it. . . . The hurricane lasted for 12 hours and was purely a local affair, as far as I could ascertain by coast and its near-by waters in the past and which constitute an index of wireless. We were hove to for 12 hours with full steam ahead, and then could not keep what may be expected in the future. As has been earlier pointed out, often SEA.—At first there is a long, rolling swell. As the storm center is approached In the issue of the New York Maritime Register for November 8, 1922, have been enumerated. No one will appreciate more than the mariner the

> region hangs. Enough has been discovered, however, to place this comparatively small area lying to the southeast of the great North Pacific trades—an area hitherto 1917, 3; 1918, 2; 1919, 2; 1920, 2; 1921, 3; 1922, 5. The years 1914 and 1916 tropical storm development, comparable in activity if not in size with the better-known areas of the West Indies and the China Sea. It is the hope that

slender thread of circumstance upon which the story of the storms of this

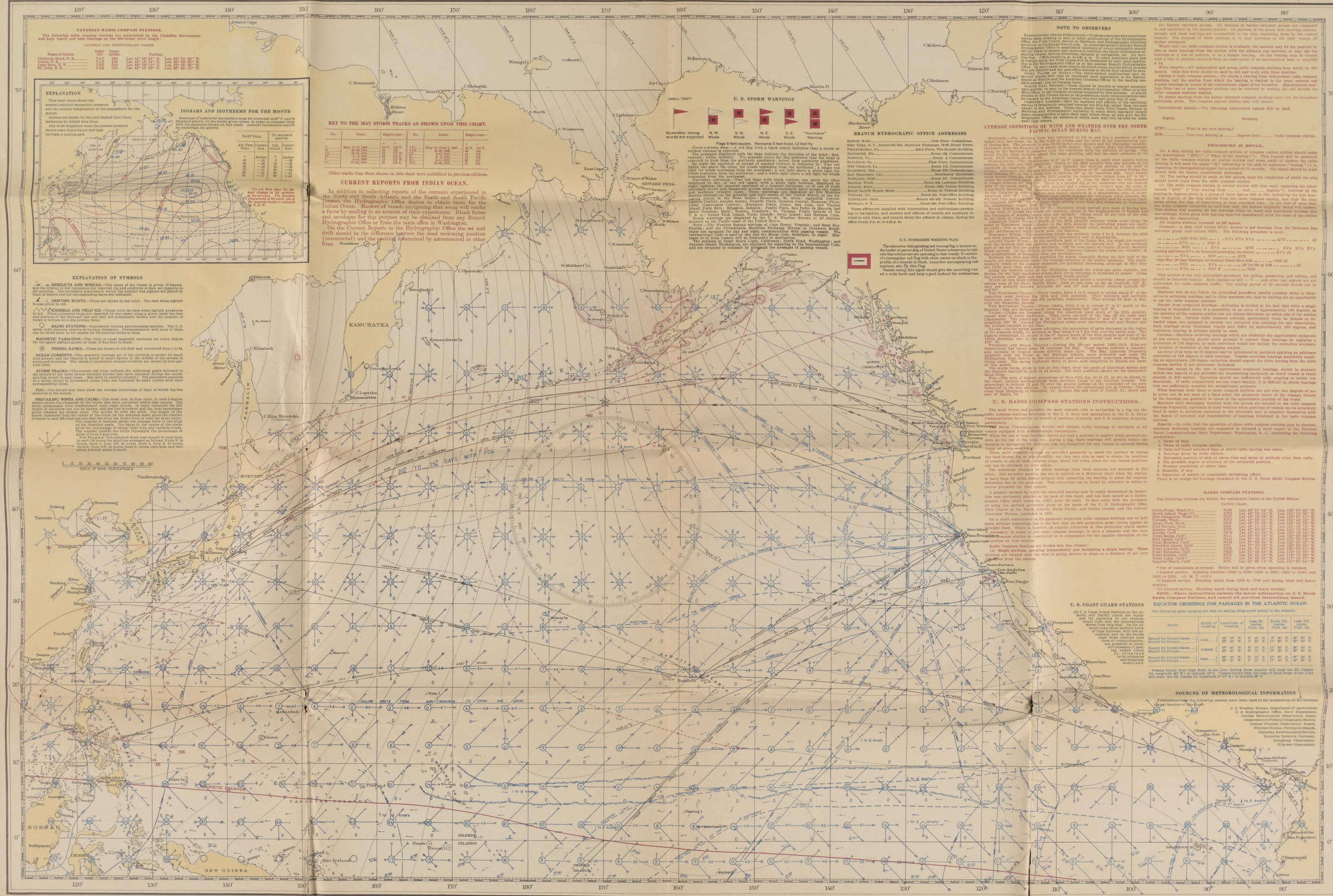






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